## SCIENTIFIC LITERATURE.

*Vorlesungen über die Elektromagnetische Theorie des Lichts*, von H. von Helmholtz. Herausgegeben von Arthur König und Carl Runge. Hamburg and Leipzig, Verlag von Leopold Voss. 1897.

Since the experiments of Hertz proved the existence of electro-magnetic waves propagated through dielectrics, the attention of an increasing number of physicists has been turned to the careful study of Maxwell's 'Electro-magnetic Theory of Light,' and the belief has become practically universal that this theory, in its general outlines at least, corresponds closely to physical facts. Several hundred important papers on matters more or less nearly related to the theory have been published during the last ten years, and the results of investigation have been made fairly accessible to students through the books of Boltzmann, Drude, Hertz, Poincaré, J. J. Thomson and others. When, however, a great university teacher, who has had much to do with the creating of a new branch of science, writes a systematic treatise on the subject for the use of his pupils, the event must always be of interest to the scientific world, and this is especially true when the subject is so important and in some respects still so abstruse as the Electro-magnetic Theory of Light is. The lectures, which are now published under the editorship of Professors König and Runge, were delivered substantially in their present form by Helmholtz in the Winter Semester of 1892–93. An accurate stenographic report of the words of the lecturer was made by Dr. Borchardt, and this report, with slight editorial changes, made in part by Helmholtz himself, and with some additions, made by his directions, to the chapters on Geometrical Optics, is reproduced in a beautifully printed royal octavo volume of about 370 pages.

The lectures begin with a short account of the Newtonian and the Huyghenian Theories of Light and of the objections to each of them. A discussion of the conditions which the propagation of plane longitudinal and transverse waves through elastic media presupposes, makes clear the necessity of ascribing to the ether the elastic properties of a solid, if it is to transmit transverse vibrations mechanically, and leads naturally to a preliminary presentation of Maxwell's theory based on Faraday's conceptions of magnetic and dielectric polarizations. After this introduction, a long chapter is devoted to a very simple and clearly written but very complete discussion of electro-magnetic oscillations, intelligible to any person who already has a fair knowledge of the meaning of polarization and of the differences between 'real,' 'apparent' and 'induced' magnetic and electric densities. This discussion calls attention anew to the fact that the nomenclature and the notation of the subject are in a very unsatisfactory state. Helmholtz himself sometimes defined inductivity so as to make that of the ether 1 and sometimes so as to make it $4\pi$, and the editors of these lectures were obliged to change the notation in some places so as to make the whole book consistent. The subject will be needlessly difficult for students so long as different writers give the name 'polarization,' without any modifying clause, to three very different quantities.

In transforming Maxwell's equations for electro-magnetic fields, Helmholtz treats the principles first elucidated in his own great paper on Vortex Motion, published in 1858, simply as analytical devices useful in integrating differential equations of a certain form. Neither here nor elsewhere in the book does the lecturer make any reference to his own contributions to the subject. In the third chapter the properties of spherical waves are studied in detail, and Huyghens's Principle is put into a very satisfactory shape by the help of an extended form of Green's Theorem in which the time and the space coordinates appear as independent variables. This makes it possible to treat Diffraction, Interference and Geometrical Optics in the next two chapters very much as they are treated in older books on the Undulatory Theory of Light.

The final chapter is devoted mainly to Polarization, Absorption and Dispersion, and is especially interesting since it gives the author's theory of Dispersion in its latest form. This theory assumes that every molecule of matter is made up of two ions, one charged positively and the other negatively. The amounts of these two charges in any molecule are very large and numerically equal, and each depends only upon

the valency of the ion in that molecule and not upon the chemical nature of the ion. Under the influence of electric force, the ions in any molecule may be made to take up a new position while their center of mass remains fixed. If the force varies periodically, a part of the energy of the field is used in keeping up the oscillations of the ions about this center of gravity in the face of heat losses. Helmholtz applies Hamilton's Principle to the equation of energy and arrives at results which correspond fairly well to observed facts.

The whole book is written in delightfully simple language and seems to be quite free from typographical errors. We merely note, in passing, that George Green held a fellowship in Cambridge from 1839 until his death in 1841, but never a professorship there. These lectures form one of a projected set of six volumes of Helmholtz's Vorlesungen über Theoretische Physik which will be extremely useful to students of physics all over the world.

HARVARD UNIVERSITY. B. O. PEIRCE.

## *THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.*

### GENERAL PROGRAM.

THE regular meeting of the Council will be at the Hotel Cadillac (hotel headquarters) at noon on August 7th.

On Monday, August 9th, at 9 a. m., the Council will meet in the Council Room, Central High School.

The first General Session of the Association will be held at 10 a. m., in the Auditorium of the Central High School. Owing to the death of Professor Edward D. Cope, the President of the Association, Professor Theodore Gill, of Washington, D. C., as Senior Vice-President, will call the meeting to order and introduce the President-elect, Professor Wolcott Gibbs, of Newport, R. I. Addresses of welcome will be made by his Honor Mayor William C. Maybury and Hon. Thomas W. Palmer, and President Gibbs will reply. Announcements by the General, Permanent and Local Secretaries will then be made.

The Addresses of the Vice-Presidents will be given in the afternoon as recorded below. In the evening Professor Theodore Gill, of Washington, D. C., will give a memorial address on the life and work of the late President, Professor Edward D. Cope. Following this address there will be a reception given by the citizens of Detroit.

On Tuesday, Wednesday, Thursday and Friday the regular meetings of the Council will be held at 9 a. m. and of the general session at 10 a. m., followed in the mornings and afternoons by the meetings of the sections.

On Friday morning officers will be elected and an agreement reached on the place of meeting for 1898, the fiftieth anniversary of the Association. The concluding exercises and adjournment of the sections of the Association and a social reunion and reception by the Ladies' Reception Committee will take place in the evening.

On Saturday there will be an excursion to Ste. Claire Flats.

It is expected that the members of the Association at Detroit will go in a body to Toronto to join in welcoming the members of the British Association to America. For this purpose special rates will probably be secured by steamer and train from Detroit to Toronto.

The programs of the sections are given below. These are as complete as possible up to the time of issue of this number of SCIENCE, but other papers will be presented at the meeting and entered on the daily programs.

### SECTION A.—MATHEMATICS AND ASTRONOMY.

Address of the Vice-President: A Chapter in the History of Mathematics. By Professor W. W. Beman, University of Michigan, Ann Arbor, Mich.

1. A Problem in Substitution-groups. By Dr. G. A. Miller, Ann Arbor, Mich.

2. Continuous Groups of Spherical Transformations in Space. By Professor H. B. Newson, Lawrence, Kans.

3. The Treatment of Differential Equations by Approximate Methods. By Professor W. F. Durand, Ithaca, N. Y.

4. Commutative Matrices. By Professor J. B. Shaw, Jacksonville, Ill.

5. On the Theory of the Quadratic Equation. By Professor A. Macfarlane, Lehigh Univ., South Bethlehem, Pa.

6. A New Principle in solving certain Linear